

Article

Nursing care intensity and cost profiles in oncology inpatients: A supportive care perspective

Haoyun Dong^{1,†}, Fangfang Lu^{2,†}, Minjia Li^{1,*}

¹ Department of Rehabilitation Medicine, The 903rd Hospital of the Joint Logistic Support Force, Hangzhou 310000, China

² Department of Medical Oncology, The 903rd Hospital of the Joint Logistic Support Force, Hangzhou 310000, China

* Corresponding author: Minjia Li, lmnjia@126.com

† These authors contributed equally to this work as first authors.

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Abstract: Inpatient oncology care involves substantial clinical and supportive care demands, with nursing care representing a major component of inpatient workload and resource utilisation. This retrospective observational study examined nursing care intensity and cost burden among hospitalised oncology patients using routinely collected administrative data from a tertiary hospital. Nursing care intensity was operationalised as nursing cost per inpatient day to standardise workload across admissions with varying lengths of stay. Descriptive analyses were performed alongside non parametric comparisons by diagnosis type and discharge outcomes, and associations between length of stay and cost indicators were assessed using Spearman correlation analysis. A total of 17,331 admissions were included. Hospital cost and nursing cost demonstrated marked right skewness, indicating concentration of resource utilisation among a subset of patients. Admissions involving malignant disease were associated with significantly higher nursing and total hospital costs and longer hospitalisation compared with benign tumour related admissions. Nursing care intensity was relatively evenly distributed across low, medium, and high categories, while patients with unfavourable discharge outcomes experienced substantially greater cumulative and daily nursing care burden. Length of stay was strongly associated with cumulative nursing and hospital costs but showed only a weak association with daily nursing care intensity. These findings suggest that nursing cost per inpatient day captures aspects of care complexity beyond duration of hospitalisation and may support more responsive supportive care planning and nursing workforce allocation in inpatient oncology services.

Keywords: cancer nursing; discharge outcomes; inpatient oncology care; nursing care intensity; supportive care; workforce planning

1. Introduction

Advances in cancer detection and treatment have resulted in a growing population of patients requiring inpatient oncology care. While improvements in survival and treatment effectiveness represent significant progress in oncology, they have also intensified the demands placed on hospital-based care systems. Inpatient oncology services are characterized by complex treatment regimens, frequent monitoring requirements, and a high prevalence of treatment-related complications, all of which contribute to substantial clinical workload and rising healthcare costs [1,2]. Within this context, nursing care constitutes a central component of supportive oncology care and represents a major contributor to care intensity and resource utilization during hospitalization [2,3].

Oncology nurses play a pivotal role in inpatient care delivery, encompassing

symptom assessment and management, administration of anticancer therapies, monitoring for adverse events, coordination of multidisciplinary care, and ongoing support for patients and their families [4,5]. These responsibilities often extend beyond technical and procedural tasks to include sustained emotional engagement, communication support, and facilitation of decision-making in the context of uncertainty and distress [5,6]. As a result, nursing workload in oncology settings is closely intertwined with both clinical complexity and psychosocial care demands, even when psychological outcomes are not directly measured [7]. Understanding how nursing care intensity is distributed within inpatient oncology services is therefore essential for planning sustainable supportive care models and maintaining workforce resilience [2].

Care intensity in inpatient oncology is influenced by multiple factors, including treatment-related toxicity, symptom burden, and the clinical trajectory during hospitalization. Patients who experience complications, prolonged recovery, or deterioration during admission may require more frequent nursing interventions and closer observation, leading to increased nursing workload and associated costs [8]. Despite this, existing research has predominantly focused on physician-driven resource utilization or aggregate hospital expenditure, with comparatively limited attention paid to nursing-specific indicators of care burden [9]. As nursing costs are often embedded within total hospital charges, the specific contribution of nursing care to inpatient workload and economic burden remains insufficiently characterized [10].

From a psycho-oncology perspective, nursing care intensity can be conceptualized as an indirect indicator of patient complexity and supportive care needs [11]. Higher levels of nursing involvement are frequently associated with increased symptom distress, emotional vulnerability, and the need for sustained communication and coordination of care [12]. Although administrative datasets do not capture psychosocial outcomes directly, they provide valuable insights into where nursing resources are most heavily concentrated and where supportive care demands are likely to be greatest [13]. Such information is particularly relevant in the context of ongoing nursing workforce shortages and increasing pressure to optimize supportive care delivery within constrained healthcare systems [14].

However, there remains a notable gap in the literature regarding the systematic profiling of nursing care intensity and cost burden among hospitalized oncology patients using routinely collected data. Few studies have examined nursing workload through cost-based indicators or explored how nursing care intensity varies across inpatient trajectories and discharge outcomes [15]. This lack of system-level evidence limits the ability of healthcare organizations to anticipate nursing care demands and allocate resources in a manner that supports both patient care quality and workforce sustainability [16,17].

To address these gaps, the present study aims to characterise nursing care intensity and cost profiles among hospitalised oncology patients using routinely collected administrative data. By examining nursing cost, total hospital cost, length of stay, and nursing care intensity across diagnosis type and discharge outcomes, this study seeks to identify patient groups associated with concentrated nursing care burden. Framed within a supportive care perspective, the findings are intended to inform resource allocation, nursing workforce planning, and the development of

sustainable inpatient oncology care models that are sensitive to clinical complexity and associated supportive care demands

2. Methods

2.1. Study design and data source

This study employed a retrospective observational design using routinely collected inpatient administrative data from the 903rd Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army, a tertiary level hospital providing comprehensive oncology services. The dataset comprised hospitalised admissions involving patients managed within oncology related care pathways during the study period. Administrative data were selected to enable system level examination of nursing care intensity and cost burden across a large inpatient population, consistent with the study aim of informing supportive care planning and nursing workforce sustainability.

All data were anonymised prior to analysis. Patient identifiers were removed, and analyses were conducted at the admission level. The study focused on describing patterns of nursing workload and resource utilisation rather than evaluating clinical efficacy or treatment outcomes.

2.2. Study population

The study population included all hospitalised oncology admissions recorded during the study period. Admissions were eligible for inclusion if complete information was available for length of stay, total hospital cost, and nursing cost. Both malignant cancer admissions and admissions related to benign tumour conditions managed within oncology services were included. Benign tumour related admissions were retained as a comparison group to contextualise nursing care burden associated with malignant disease and should not be interpreted as cancer diagnoses.

Admissions with incomplete cost data or missing length of stay information were excluded from analyses requiring derived intensity measures. The final analytic sample size varied slightly across analyses due to missing data for specific variables.

2.3. Variables and definitions

Length of stay was defined as the number of inpatient days from admission to discharge. Total hospital cost represented the aggregated cost incurred during the hospitalisation episode, encompassing all billed services. Nursing cost reflected the component of hospital expenditure attributed to nursing care activities during admission and was used as a proxy indicator of nursing workload. Nursing care intensity was operationalised as nursing cost per inpatient day to standardise nursing workload across admissions with varying lengths of stay. This derived measure was used to capture daily nursing care burden independent of hospitalisation duration.

Diagnosis type was classified as benign tumour related condition or malignant disease based on administrative diagnostic coding. Diagnosis type was used as a structural indicator of clinical complexity and care burden rather than as a psychosocial classification. Discharge outcome was categorised according to

administrative discharge records and included outcomes such as recovery, clinical improvement, death, untreated status, ineffective treatment response, and other outcomes. Discharge outcome was used to characterise inpatient clinical trajectories and examine associations with nursing care burden.

2.4. Statistical analysis

Descriptive statistics were used to summarise patient characteristics, hospitalisation duration, and cost variables. Continuous variables were examined for distributional characteristics and are presented as mean with standard deviation and median with interquartile range due to skewed distributions. Categorical variables are presented as frequencies and percentages.

Nursing care intensity was categorised into low, medium, and high intensity groups based on tertiles of nursing cost per inpatient day to facilitate burden profiling and comparison across patient groups. Missing intensity values resulted from incomplete cost or length of stay data and were reported descriptively.

Comparative analyses were conducted to examine differences in length of stay, nursing cost, and total hospital cost by diagnosis type. Given non normal distributions and variance heterogeneity, non-parametric Mann-Whitney U tests were used for two group comparisons. Differences in hospitalisation and cost indicators across discharge outcome categories were assessed using Kruskal-Wallis tests.

Associations between length of stay and cost related variables were examined using Spearman rank correlation coefficients to assess the role of hospitalisation duration as a driver of cumulative and daily nursing care burden. All statistical tests were two sided, and a p value of less than 0.05 was considered statistically significant.

Analyses were conducted for descriptive and exploratory purposes to characterise nursing care intensity and cost burden patterns rather than to establish causal relationships.

2.5. Ethical considerations

The study was conducted in accordance with institutional and national ethical standards for research involving human data. As the study utilised deidentified administrative data and posed minimal risk to participants, informed consent was waived. Ethical approval for data access and analysis was obtained from the institutional review board of the 903rd Hospital of the Joint Logistics Support Force of the Chinese People's Liberation Army. All procedures complied with applicable data protection and confidentiality regulations

3. Results

3.1. Sample characteristics and cost distribution

The analysis included 17,331 hospitalised oncology admissions. Summary statistics for length of stay, total hospital cost, nursing cost, and nursing cost per inpatient day are presented in **Table 1**. The median length of stay was 4 days, with an interquartile range of 2 to 8 days, although considerable heterogeneity was observed, with hospitalisation duration extending up to 365 days. Both total hospital cost and

nursing cost demonstrated pronounced right skewness. Median total hospital cost was 9295.42, substantially lower than the mean value of 15,534.47, indicating that a relatively small proportion of admissions accounted for a large share of expenditure. A similar pattern was observed for nursing cost, with a median of 151.20 compared with a mean of 362.01. In contrast, nursing cost per inpatient day showed a narrower distribution, with a median of 37.25 and an interquartile range of 26.00 to 50.29, supporting its suitability as a standardised indicator of nursing care intensity.

Table 1. Descriptive statistics of hospitalisation, cost, and nursing care intensity among oncology inpatients.

Variable	<i>n</i>	Mean	SD	Median	Q1	Q3	Min	Max
Length of stay days	17,331	6.69	12.09	4	2	8	0	365
Total hospital cost	17,329	15,534.47	27,322.43	9295.42	5719.36	16,221.39	126.50	855,061.82
Nursing cost	17,331	362.01	1677.91	151.20	78.00	312.00	1.30	62,393.75
Nursing cost per inpatient day	17,074	42.77	23.80	37.25	26.00	50.29	6.20	343.72

Note: Continuous variables are presented as mean with standard deviation and median with interquartile range to account for skewed distributions of cost and length of stay.

When stratified by diagnosis type, patients with malignant cancer disease demonstrated longer hospitalisation and greater resource utilisation compared with those with benign conditions, as shown in **Table 2**. The mean length of stay among malignant admissions was 6.95 days, compared with 4.93 days for benign admissions, although median values were similar across groups. Nursing cost was substantially higher among malignant cases, with a median of 158.00 compared with 104.00 for benign cases, and markedly greater variability was observed within the malignant group. A similar pattern was evident for total hospital cost, with malignant admissions demonstrating higher median and mean expenditures and a wider range of values.

Table 2. Hospitalisation duration and cost characteristics by cancer diagnosis type.

Variable	Diagnosis type	<i>n</i>	Mean (SD)	Median (IQR)	Min	Max
Length of stay days	Benign	2235	4.93 (5.01)	4.00 (2.00–6.00)	0	81
	Malignant	15,062	6.95 (12.80)	4.00 (2.00–8.00)	0	365
Nursing cost	Benign	2235	175.68 (358.14)	104.00 (52.00–182.00)	8.20	9776.18
	Malignant	15,062	389.47 (1792.82)	158.00 (78.00–338.00)	1.30	62,393.75
Total hospital cost	Benign	2235	9700.95 (9514.39)	7028.57 (5266.03–9870.60)	736.67	123,417.10
	Malignant	15,060	16,395.48 (28,965.37)	9950.95 (5857.57–17,240.24)	126.50	855,061.82

Note: Values are presented as mean with standard deviation and median with interquartile range due to skewed distributions of cost and length of stay variables.

3.2. Diagnosis type differences in hospitalisation and cost

Comparative analyses demonstrated significant differences in hospitalisation and cost indicators between patients admitted with benign tumour related conditions and those with malignant disease. As shown in **Table 3**, length of stay was significantly longer among malignant admissions compared with benign admissions. Nursing cost also differed markedly by diagnosis type, with malignant cases incurring substantially higher nursing related expenditure. Similarly, total hospital cost was significantly greater among patients with malignant disease.

Table 3. Mann-Whitney U tests comparing hospitalisation and cost indicators by diagnosis type.

Outcome variable	Test	U statistic	p-value	Benign (n)	Malignant (n)
Length of stay days	Mann-Whitney U	15,472,074.5	< 0.001	2235	15,062
Nursing cost	Mann-Whitney U	12,730,261.0	< 0.001	2235	15,062
Total hospital cost	Mann-Whitney U	12,644,381.0	< 0.001	2235	15,060

Note: Non parametric Mann-hitney U tests were used due to non-normal distributions and significant variance heterogeneity, as indicated by Shapiro Wilk and Levene tests.

Non parametric Mann Whitney U tests confirmed that these differences were statistically significant for length of stay, nursing cost, and total hospital cost. These findings indicate that malignant disease is associated with greater inpatient care burden and higher nursing workload, providing important context for subsequent analyses of nursing care intensity and discharge outcomes.

3.3. Distribution of nursing care intensity

Nursing care intensity was defined as nursing cost per inpatient day to allow standardised comparison of nursing workload across hospitalised oncology patients. To facilitate burden profiling, patients were categorised into low, medium, and high intensity groups based on the distribution of this indicator. As summarised in **Table 4**, the distribution across intensity categories was relatively balanced, with approximately one third of patients assigned to each group.

Table 4. Distribution of nursing care intensity categories based on nursing cost per inpatient day.

Nursing care intensity category	Count	Percentage (%)
Low	5,751	33.18
Medium	5,762	33.25
High	5,561	32.09

Note: Nursing care intensity was defined as nursing cost per inpatient day and categorised into tertiles based on the distribution of values. Missing values reflect incomplete cost or length of stay data.

The low intensity category comprised 33.18% of admissions, while 33.25% were classified as medium intensity and 32.09% as high intensity. Only a small proportion of cases had missing intensity values due to incomplete cost or length of stay data. This distribution is also illustrated in **Figure 1**, which provides a visual overview of the relative proportions of patients across intensity categories. Together, these findings indicate that nursing care burden was not confined to a narrowly defined subgroup, while still allowing identification of patients experiencing higher levels of daily nursing care intensity for subsequent analyses.

3.4. Discharge outcome characteristics

Discharge outcomes for the study cohort are summarised in **Table 5**. The majority of patients were discharged with outcomes classified as other or clinical improvement, together accounting for more than three quarters of admissions. A further 19.13% of patients were discharged as recovered. Unfavourable outcomes, including death, untreated status, and ineffective treatment response, were uncommon,

each representing less than one percent of the cohort. This distribution provides essential clinical context for understanding subsequent analyses examining variation in nursing care intensity and cost across discharge outcomes.

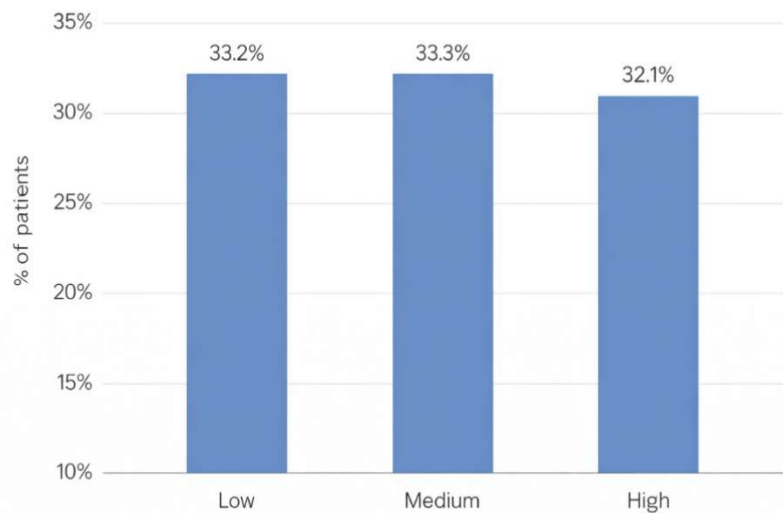


Figure 1. Distribution of nursing care intensity categories among oncology inpatients.

Table 5. Distribution of discharge outcomes among hospitalised oncology patients.

Discharge outcome	Count	Percentage (%)
Other	9883	57.02
Improved	3949	22.79
Recovered	3316	19.13
Death	85	0.49
Untreated	82	0.47
Ineffective	15	0.09

Note: Percentages (%) may not total exactly 100% due to rounding.

3.5. Nursing care burden across discharge outcomes

Comparative analyses demonstrated significant differences across discharge outcome categories for length of stay, total hospital cost, nursing cost, and nursing cost per inpatient day, as detailed in **Table 6**. Length of stay varied markedly by discharge outcome, with patients experiencing unfavourable outcomes showing substantially longer hospitalisation. Total hospital cost and nursing cost also differed significantly across outcome groups, indicating that both economic and nursing care burden were unevenly distributed across inpatient trajectories. Notably, nursing cost per inpatient day showed particularly pronounced variation across discharge outcomes, suggesting that daily nursing care intensity is closely linked to clinical complexity and inpatient course rather than duration of hospitalisation alone. These findings indicate that nursing burden is concentrated among patients with more complex or adverse discharge trajectories.

Table 6. Kruskal-Wallis tests comparing hospitalisation and cost outcomes across discharge outcome categories.

Outcome variable	H statistic	p-value	Group sizes
Length of stay days	702.89	< 0.001	[9883, 3949, 15, 82, 85, 3316]
Total hospital cost	466.80	< 0.001	[9881, 3949, 15, 82, 85, 3316]
Nursing cost	254.73	< 0.001	[9883, 3949, 15, 82, 85, 3316]
Nursing cost per inpatient day	1793.95	< 0.001	[9656, 3935, 14, 81, 81, 3306]

Note: Kruskal-Wallis tests were used due to non-normal distributions of cost and length of stay variables. Group sizes correspond to discharge outcome categories in the order of other, improved, ineffective, untreated, death, and recovered.

3.6. Relationship between length of stay and cost indicators

The relationship between length of stay and cost related indicators was further examined using Spearman correlation analysis, with results presented in **Table 7**. Length of stay showed a very strong positive association with total nursing cost and a strong association with overall hospital cost. In contrast, the correlation between length of stay and nursing cost per inpatient day was weak, despite statistical significance. This pattern indicates that prolonged hospitalisation substantially increases cumulative nursing workload and economic burden, whereas daily nursing care intensity remains relatively stable. These findings further support the use of nursing cost per inpatient day as a standardised measure of nursing care intensity that is less dependent on hospitalisation duration.

Table 7. Spearman correlations between length of stay and cost related indicators.

X-variable	Y-variable	Spearman rho	p-value	n
Length of stay days	Nursing cost	0.93	< 0.001	17,331
Length of stay days	Total hospital cost	0.68	< 0.001	17,329
Length of stay days	Nursing cost per inpatient day	0.13	< 0.001	17,074

Note: Spearman correlation coefficients were used to assess associations between length of stay and cost indicators due to skewed distributions of the variables.

4. Discussion

This study provides a comprehensive system level analysis of nursing care intensity and cost burden among hospitalised oncology patients, drawing on routinely collected administrative data to characterise how nursing workload and economic resource use are distributed across inpatient care trajectories. By integrating measures of nursing cost, total hospital cost, length of stay, diagnosis type, and discharge outcomes, the findings offer a multidimensional perspective on inpatient oncology care that is directly relevant to supportive care planning and nursing workforce sustainability.

One of the central findings of this study is the substantial heterogeneity in both cumulative and daily nursing care burden across hospitalised oncology admissions. Overall cost and nursing expenditure demonstrated pronounced right skewness, indicating that a relatively small proportion of admissions account for a disproportionate share of inpatient resource utilisation. This pattern is consistent with prior health services research and underscores the importance of moving beyond

average estimates when planning supportive oncology services. For nursing practice, such concentration of workload suggests that staffing demands are not evenly distributed across patients and may fluctuate considerably depending on clinical complexity and inpatient course [18,19].

The stratification of admissions by diagnosis type revealed that patients with malignant disease experienced significantly greater length of stay, nursing cost, and total hospital cost compared with those admitted for benign tumour related conditions. Although median length of stay was similar between groups, malignant admissions demonstrated greater variability and markedly higher cumulative resource use. This finding suggests that malignant disease is associated with more complex and resource intensive inpatient trajectories that extend beyond duration of hospitalisation alone [20,21]. From a nursing perspective, such complexity likely reflects increased symptom burden, treatment related toxicity, and heightened monitoring requirements, all of which contribute to greater nursing workload and sustained patient engagement [22].

The observed differences in nursing cost by diagnosis type have important implications for supportive care delivery. Nursing cost encompasses not only technical and procedural care but also relational work, symptom management, and coordination of multidisciplinary interventions. Higher nursing costs among malignant admissions therefore signal a greater concentration of nursing effort in this group, which may include increased emotional labour and communication demands associated with cancer care [23,24]. While psychosocial outcomes were not directly measured, nursing care intensity may serve as an indirect indicator of supportive care need, particularly in inpatient settings where patients and families often face heightened uncertainty and distress [25,26].

Beyond diagnosis type, discharge outcomes emerged as a key factor associated with nursing care burden. Patients with unfavourable discharge trajectories demonstrated significantly longer hospitalisation and higher cumulative and daily nursing costs compared with those discharged as recovered or improved. These findings indicate that nursing workload intensifies in the context of clinical deterioration or treatment failure [27]. From a psycho-oncology perspective, such inpatient trajectories are often accompanied by complex decision making, emotional distress, and increased need for communication with patients and families [28]. The concentration of nursing care intensity among patients with adverse outcomes highlights the critical role of nurses in providing both clinical and supportive care during periods of heightened vulnerability [29].

The use of nursing cost per inpatient day as a standardised indicator of nursing care intensity represents an important methodological contribution of this study. While length of stay showed strong associations with cumulative nursing and hospital costs, its association with daily nursing care intensity was weak. This distinction suggests that prolonged hospitalisation primarily amplifies total workload through duration, whereas daily nursing care intensity more closely reflects care complexity and intensity of nursing involvement [19]. For supportive oncology services, this differentiation is essential, as reliance on length of stay alone may underestimate periods of high nursing demand that are driven by clinical and psychosocial complexity rather than time spent in hospital [30,31].

The relatively balanced distribution of patients across low, medium, and high nursing care intensity categories further underscores that elevated nursing workload is not confined to a narrowly defined subgroup. A substantial proportion of hospitalised oncology patients experience periods of heightened daily nursing care intensity, reinforcing the need for flexible staffing models that can accommodate fluctuations in care demands. From a workforce planning perspective, recognising and monitoring nursing care intensity may enable more responsive allocation of nursing resources and support proactive supportive care interventions [32–34].

Several implications for practice and policy emerge from these findings. First, inpatient oncology services should recognise that nursing care burden is shaped by both diagnosis type and inpatient clinical trajectory, with malignant disease and adverse discharge outcomes associated with higher intensity care. Second, incorporating nursing care intensity indicators into routine service monitoring may enhance the ability of healthcare organisations to anticipate staffing needs and allocate resources more equitably. Third, early identification of patients at risk of high intensity care trajectories may support timely integration of supportive and palliative care approaches, potentially mitigate downstream workload pressures while improving patient and family experience [35].

This study has limitations that should be acknowledged. Administrative cost data provide an indirect measure of nursing workload and do not capture qualitative aspects of nursing care, including emotional labour, relational support, and informal caregiving activities that are central to psycho-oncology practice. In addition, diagnosis type was used as a structural indicator of clinical complexity rather than as a direct measure of psychosocial need. Despite these limitations, the use of large-scale administrative data offers valuable system level insights that are difficult to obtain through primary data collection and enables examination of nursing care patterns across a broad inpatient population.

This study demonstrates that nursing care intensity and cost burden among hospitalised oncology patients vary substantially by diagnosis type, discharge outcomes, and length of stay. Patients with malignant disease and complex inpatient trajectories account for a disproportionate share of nursing workload and economic resource utilisation. By operationalising nursing care intensity using cost-based indicators, the findings provide actionable evidence to inform supportive care planning, nursing workforce strategies, and the sustainable delivery of inpatient oncology care. These insights are directly relevant to psycho-oncology, where understanding and addressing the interplay between clinical complexity, supportive care needs, and nursing workload is essential for high quality patient centred care.

5. Conclusion

This study provides system level evidence on nursing care intensity and cost burden among hospitalised oncology patients using routinely collected administrative data from a tertiary hospital setting. By operationalising nursing care intensity through nursing cost per inpatient day and examining its distribution in relation to diagnosis type, discharge outcomes, and length of stay, the findings offer a structured understanding of how nursing workload and economic resources are concentrated

within inpatient oncology services.

Patients with malignant disease and those experiencing unfavourable discharge trajectories were found to account for a disproportionate share of nursing care burden and total hospital cost. While prolonged hospitalisation substantially increased cumulative workload, daily nursing care intensity appeared less dependent on length of stay and more reflective of clinical complexity and supportive care demands. These patterns highlight the importance of moving beyond length of stay alone when planning nursing workforce capacity and supportive oncology services.

From a psycho-oncology perspective, the concentration of nursing care intensity among patients with complex inpatient trajectories underscores the close interrelationship between clinical burden and supportive care needs. Although psychosocial outcomes were not directly measured, nursing care intensity may serve as a practical proxy for periods of heightened emotional, communicative, and supportive demands placed on nursing staff and patients alike. Recognising these patterns is essential for developing sustainable care models that support both patient wellbeing and nursing workforce resilience.

In conclusion, integrating nursing care intensity indicators into routine service evaluation may enhance the ability of healthcare systems to anticipate supportive care demands, allocate nursing resources more effectively, and sustain high quality inpatient oncology care. Future research should build on these findings by linking administrative indicators of nursing workload with patient reported and psychosocial outcomes to further inform person centred supportive care planning in oncology.

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Informed consent statement: This study is a retrospective analysis and does not require patients to sign an informed consent form.

Conflict of interest: The authors declare no conflict of interest.

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